ONION PRODUCTION FROM TRANSPLANTS IN 2021

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Introduction

Interest in an earlier start for onion harvest and marketing has led to interest in transplanting onions. In the Treasure Valley, onions are available out of the field from mid-August through October and then out of storage from October through March. An earlier harvest would extend the time when local onions are available, which is important for onion processors and for onion packing sheds. Onion varieties suitable for processing into onion rings must be single centered, produce large bulbs, and store well. Previous research at the OSU Malheur Experiment Station (MES) has shown that when onions are grown from transplants, they can be harvested starting in July (Shock et al. 2004, 2007–2009, 2011–2019; Reitz et al. 2020). The 2021 trial evaluated two yellow and two red onion varieties grown from transplants potentially suitable for processing or fresh market.

Materials and Methods

Transplants were grown at MES in a heated greenhouse with minimum air temperatures during the day of 65°F and 45°F at night. Onion seed of varieties 'HSO104', 'TAS-37', 'TAS027', and 'TAS-42' (New Zealand Onion, Pukekohe, New Zealand) was planted in the greenhouse on January 21, 2021 in flats with a vacuum seeder at 72 seeds/flat. The seed was sown on a 1-inch layer of Sun Gro Horticulture professional growing mix (Sun Gro Horticulture, Agawam, MA). The seed was then covered with 1 inch of the potting mix. The flats were placed in metal trays in the greenhouse. Immediately after planting, the trays were filled with enough water to allow the flats to be kept moist. Onion seedlings began emerging on February 2. Transplants were grown without supplemental light.

Onions were grown from the transplants on an Owyhee silt loam at MES previously planted to wheat. After the wheat was harvested in 2020, the stubble was shredded, and the field was irrigated to sprout unharvested wheat kernels, and then the field was disked and plowed. A soil analysis taken in the fall of 2020 showed a pH of 7.4, 3.5% organic matter, 2 ppm nitrogen (N) as nitrate, 3 ppm N as ammonium, 32 ppm phosphorus (P), 437 ppm potassium (K), 29 ppm sulfur as sulfate (S), 2796 ppm calcium, 614 ppm magnesium, 274 ppm sodium, 3.3 ppm zinc (Zn), 3 ppm manganese (Mn), 1 ppm copper (Cu), 7 ppm iron, and 1 ppm boron (B). Based on the soil analysis, 50 lb N/acre, 44 lb P/acre, 83 lb K/acre, 200 lb S/acre, 11 lb Mn/acre, 2 lb Cu/acre, and 1 lb B/acre were broadcast after plowing. In addition to the chemical fertilizer, 10 tons/acre of composted cattle feedlot manure were broadcast after plowing. After plowing the field was groundhogged, fumigated with Vapam® at 15 gal/acre, and bedded at 22 inches.

Drip tape was laid at 4-inch depth between pairs of onion beds before planting. The drip tape had emitters spaced 8 inches apart and an emitter flow rate of 0.09 gal/hour (0.22 gal/min/100 ft,

Toro Aqua-Traxx, Toro Co., El Cajon, CA). The distance between the tape and the center of each double row of onions was 11 inches.

The seedlings were transplanted on March 25. The seedlings were transplanted on four 22-inch beds in double rows 3 inches apart. The spacing between plants in each row was 4.8 inches, equivalent to 120,000 plants/acre. Five plots of each variety were planted. Plots were 20 ft long by 4 double rows wide.

The onion crop was managed to minimize yield reductions from weeds, pests, diseases, water stress, and nutrient deficiencies. The following herbicides were broadcast for weed control: Poast® (sethoxydim) at 24 oz/acre on April 15, Prowl® H_2O (pendimethalin) at 2 pints/acre on April 23, GoalTender® (oxyfluorfen) at 4 oz/acre, Brox® 2EC (bromoxynil) at 16 oz/acre, and Poast at 24 oz/acre on May 13. Thrips were controlled by ground application using the following insecticides: Aza-Direct® (azadirachtin) at 12 oz/acre and M-Pede® (potassium salts of fatty acids) at 123 oz/acre on May 5, Aza-Direct at 12 oz/acre and Movento® (spirotetramat) at 5 oz/acre on May 17 and May 26, and Exirel® (cyantraniliprole) at 8 oz/acre on June 2 and June 15.

A total of 95 lb N/acre was applied in four 24-lb increments during the season as urea ammonium nitrate solution (URAN) injected through the drip tape.

Onions were irrigated automatically to maintain the soil water tension (SWT) in the onion root zone below 20 cb (Figure. 1, Shock et al. 2000). Soil water tension was measured with eight granular matrix sensors (GMS, Watermark soil moisture sensor model 200SS, Irrometer Co. Inc., Riverside, CA) installed at 8-inch depth in the center of the double row. Sensors had been calibrated to SWT (Shock et al. 1998). The GMS were connected to the datalogger via multiplexers (AM16/32, Campbell Scientific, Logan, UT). The datalogger (CR1000, Campbell Scientific) read the sensors and recorded the SWT every hour. The datalogger automatically made irrigation decisions every 12 hours. The field was irrigated if the average SWT of the eight sensors was 20 cb or higher. The irrigations were controlled by the datalogger using a controller (SDM-CD16AC, Campbell Scientific) connected to a solenoid valve. Irrigation durations were 8 hours, 19 min, to apply 0.48 inch of water. The water supply was well water maintained at a constant water pressure of 35 psi. The pressure in the drip lines was maintained at 10 psi by a pressure-regulating valve. The automated irrigation system was started on April 28 and terminated on August 3.

Bulbs of each variety were harvested twice two weeks apart. Harvests for each variety were started when approximately 75% of the tops were down. At each harvest, bulbs from 10 ft of the middle two double rows in each plot were topped and bagged. Decomposing bulbs were not bagged. At each harvest, onions in each plot were rated visually for the percentage of tops that were down. Following each harvest, the onions were graded. Bulbs were separated according to quality: bulbs without blemishes (No. 1s), split bulbs (No. 2s), bulbs infected with neck rot (*Botrytis allii*) in the neck or side, plate rot (*Fusarium oxysporum*), or black mold (*Aspergillus niger*). The No. 1 bulbs were graded according to diameter: small (<2¼ inches), medium (2¼–3 inches), jumbo (3–4 inches), colossal (4–4¼ inches), and super colossal (>4¼ inches). Bulb counts per 50 lb of super colossal onions were calculated for each plot of every variety by weighing and counting all super colossal bulbs during grading.

After grading, bulbs from each harvest were stored in a shed at ambient temperature for 2 weeks. After 2 weeks the bulbs were evaluated for single centers and for the number of sprouted or decomposed bulbs.

Twenty-five onions ranging in diameter from 3½ to 4¼ inches from each plot from each harvest were rated for single centers. The onions were cut equatorially through the bulb middle and separated into single-centered and multiple-centered bulbs. The multiple-centered bulbs had the long axis of the inside diameter of the first single ring measured. These multiple-centered onions were ranked according to the diameter of the first single ring: small multiple-centered onions had diameters under 1½ inch, medium multiple-centered onions had diameters from 1½ to 2¼ inches, and large multiple-centered onions had diameters over 2¼ inches. Onions were considered "functionally single centered" for processing if they were single centered or had a small multiple center.

Variety differences were compared using repeated measures analysis of variance. Means separation was determined using a protected Fisher's least significant difference test at the 5% probability level, LSD (0.05).

Results and Discussion

The months of June and July had air temperatures substantially higher than average (Table 1). The average maximum air temperature for July was the highest since records began at the Malheur Experiment Station in 1943 (Table 5). The average low temperatures for June and July were the highest since 1943. The months of June and July combined had the highest total degree days above 86°F since 1943.

At the first harvest all varieties were at 70% or higher tops down (Table 2). There was no statistically significant difference between varieties in yield or grade. Averaged over varieties, there was a statistically significant marketable yield increase from the first to the second harvest.

Variety TAS027 was in the transplant trial in 2020 (Table 3). On July 20, 2021, TAS027 was at approximately the same maturity as on July 30, 2020, indicating the earlier maturity in 2021. Yields of TAS027 were lower in 2021 than in 2020, despite the later harvest dates in 2021.

Variety TAS-37 was among the varieties with the highest percentage of functionally single centered bulbs (Table 4).

No bolting was observed for any of the varieties. No bulb decomposition or sprouting was observed for any of the varieties after 2 weeks of storage.

Acknowledgements

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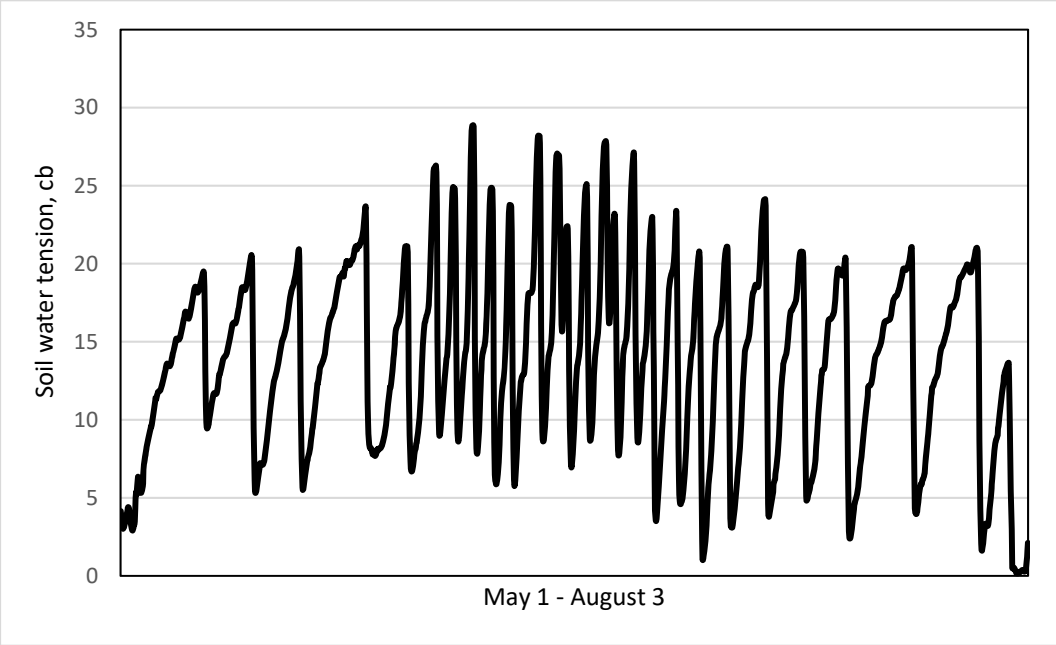

Figure 1. Soil water tension at 8-inch depth, Malheur Experiment Station, Oregon State University, Ontario, OR, 2021.

Table 1. Monthly average air temperature (°F) for 2021 and 1943-2021 average, Malheur Experiment Station, Oregon State University, Ontario, OR, 2021.

		Apr	May	Jun	Jul
Maximum	2021	66.7	73.5	90.6	98.7
	Average	64.3	73.5	81.8	91.9
Minimum	2021	35.2	47.0	58.9	65.4
	Average	37.3	45.2	52.1	58.3

Table 2. Bulb yield, grade, and maturity over two harvest dates for four onion varieties grown from transplants, Malheur Experiment Station, Oregon State University, Ontario, OR, 2021.

				Marketable yield by grade							
Variety	Color	Harvest date	Total yield	Total	>4¼ in	4-4¼ in	3-4 in	2¼-3 in	Small	Tops down	Leaf dryness
			---------- cwt/acre ----------							--- % ---	
HSO104	yellow	8-Jul	472.4	432.6			274.0	158.5	39.9	77.5	16.3
		22-Jul	511.7	481.3			324.7	156.6	30.4	98.8	37.5
		average	492.1	456.9			299.4	157.6	35.1	88.1	26.9
TAS-37	yellow	13-Jul	464.0	425.1			315.4	109.7	39.0	84.0	15.0
		27-Jul	504.2	475.8			385.6	90.2	28.3	93.8	21.3
		average	484.1	450.5			350.5	99.9	33.7	88.9	18.1
TAS-42	red	13-Jul	506.0	467.9			366.9	98.3	38.1	70.0	16.0
		27-Jul	604.9	576.2		21.4	468.4	94.9	28.8	99.0	64.0
		average	555.5	522.0			417.6	96.6	33.4	84.5	40.0
TAS027	red	20-Jul	577.2	548.3		37.1	460.4	78.6	28.9	86.3	15.0
		3-Aug	630.7	607.2		34.7	501.7	93.9	23.5	100.0	63.3
		average	604.0	577.7			481.1	86.3	26.2	93.1	39.2
Harvest date		1	504.9	468.5		37.1	354.2	111.3	36.5	79.4	15.6
		2	562.9	535.1		28.0	420.1	108.9	27.8	97.9	46.5
LSD (0.05) Variety			NS	NS		NS	NS	NS	NS	NS	3.0
LSD (0.05) Date			NS	39.6		NS	NS	NS	NS	6.8	2.8
LSD (0.05) Variety X Date			NS	NS		NS	NS	NS	NS	NS	5.7

Table 3. Yield, grade, and maturity of variety TAS027 in 2020.

		Marketable yield by grade							
Date	Total yield	Total	>4¼ in	4-4¼ in	3-4 in	2¼-3 in	Small	Doubles	Tops down
Tops		---------- cwt/acre ----------							%
16-Jul	730.1	721.7	0.0	60.0	634.5	27.2	8.5	1.1	30
30-Jul	928.2	916.6	29.9	324.4	552.2	10.1	6.9	23.5	80

Table 4. Single- and multiple-centered bulbs over two harvest dates for four onion varieties grown from transplants, Malheur Experiment Station, Oregon State University, Ontario, OR, 2021.

			Multiple center			Single center	
Variety	Color	Date	Large	Medium	Small	Functional[a]	Bullet[b]
			---------- % ----------				
HSO104	yellow	8-Jul	0.0	18.0	54.0	82.0	28.0
		22-Jul	0.0	20.0	55.0	80.0	25.0
		average	0.0	19.0	54.5	81.0	26.5
TAS-37	yellow	13-Jul	0.8	12.8	59.2	86.4	27.2
		27-Jul	0.0	13.0	72.0	87.0	15.0
		average	0.4	12.9	65.6	86.7	21.1
TAS-42	red	13-Jul	6.4	25.9	40.5	67.7	27.2
		27-Jul	9.0	19.0	48.0	72.0	24.0
		average	7.7	22.4	44.3	69.9	25.6
TAS027	red	20-Jul	11.0	19.0	44.0	70.0	26.0
		3-Aug	12.0	13.3	45.3	74.7	29.3
		average	11.5	16.2	44.7	72.3	27.7
LSD (0.05) Variety			4.3	NS	16.1	10.4	NS
LSD (0.05) Date			NS	NS	NS	NS	NS
LSD (0.05) Variety X Date			NS	NS	NS	NS	NS

[a]Functional single centers are the small multiple centers plus the bullet single centers.
[b]Bullet: single center.